

# A Survival Analysis on United States Labor-Force and Deferred Action for Childhood Arrivals (DACA) Policy Repeals

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## Abstract

It is an undeniable fact that the economy of the United States of America has very much benefited directly and indirectly from the pooled skilled labor force of both legal and illegal immigrants. Therefore, the primary objective of this study is to compare and contrast the survival function of the United States labor-force as well as employed DACA recipients' and, in the process, fit a Cox Proportional Hazard (Cox PH) model to the sampled data. The study utilized secondary and extant sources of immigration data on DACA immigrants between 2012 and 2015, coupled with labor-force data from 1995 to 2015. Additionally, the study adopted the Pearson's chi-square test statistic to evaluate the null hypothesis. As part of the results, the study found that, given the assumption of the same time limit, the U.S.A. labor force has about 78% survival within the local (U.S.A) economy, with the absence of the labor force from DACA recipients. However, when the DACA employees are added, under the same conditions, the survival of the labor force grew up to 90%, with all other things being equal. Also, the total U.S.A. labor force is more likely to experience the total risk (or cumulative hazard) rate of about 30% within the local economy. However, out of the 30% cumulative hazard rate, which is more likely to be experienced by the entire economy, about 12% will be borne by the fewer DACA employees, who are yet to face deportation. The study has the conclusion that, for the continuous growth and survival of the labor force of the United States of America, there is the need for continuity and expansion of the DACA policy.

**Keywords:** Immigrants, Labor-Force, Survival Analysis, Hazard Rate, Employment, & DACA.

## 1.0 Introduction

In 2017, the United States of America's Citizenship and Immigration Services confirmed that a total of nearly 800,000 immigrants have obtained the status of Deferred Action for Childhood Arrivals (or DACA), thereby mushrooming or adding significantly to the total labor force in the country. The Washington, DC-based think tank, Cato Institute (2017) asserted that the economy of United States has gained directly and indirectly from the collective skilled labor force from both legal and illegal immigrants. Furthermore, the conservative institute contended in its 2017 study that deporting American residents, who entered the country illegally as children, could cost the United States economy about \$280 billion. Additionally, K. D'Onofrio (2017) reiterated that the deportation of DACA participants in the United States would cost the American economy billions of dollars, as well as billions of tax revenues that would be foregone, all other things being equal.

However, Ike Brannon, the eminent economist, was quoted in the Cato Institute study as underscoring that many Americans believe that the presence of unauthorized immigrants is harmful to the economy, and that they would like to see steps taken to reduce their presence. Nevertheless, the findings of the institute's study has confirmed unequivocally that such a repeal or roll-back of DACA immigration policy would, as well, harm the economy and cost the U.S. government a significant amount of lost tax revenue both in the short-run and long-run.

Meanwhile, a recent report released by the Center for American Progress (2017) also pointed out that 91 percent of DACA recipients are currently employed by American companies throughout the country and, as a result, removing them from the workforce will cut economic output by more than \$460 billion over 10 years. However, the estimation is that such rearward policy will cost employers not less than \$3.4 billion in unnecessary turnover costs, and that it would also cut contributions to Medicare and Social Security by \$24.6 billion over a decade, which in effect can cause a huge damage to the local economy at large.

In a nutshell, many economists and political scientists have predicted devastating consequences the DACA policy would inflict on U.S. labor force, as well as the dire far-reaching consequences to communities across the country as well as to employers, and to the American economy across all regions and sectors if the policy is not properly reviewed. In light of the foregoing details, it is part of the primary objective of this study to compare and contrast the survival function of the United States labor-force as well as employed DACA recipients and also to provide a fit Cox Proportional Hazard (Cox PH) model to the sampled data.

## 2.0 Literature Review

### Historical Development of Deferred Action for Childhood Arrivals (DACA)

An empirical research report from the U.S. Migration Policy Institute revealed that there are more than forty-three (43) million immigrants in the United States of America. Out of the number, eleven (11) million are

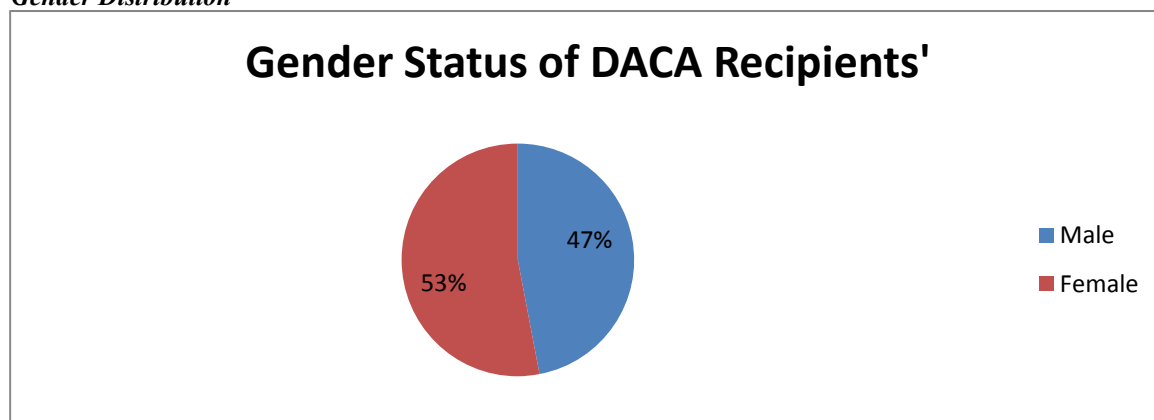
undocumented. Therefore, in the year 2012, President Barack Obama and his administration implemented the Deferred Action for Childhood Arrivals –DACA-DREAM ACT bill (DACA), an American immigration policy that allowed some individuals, who entered the country as minors and had either entered or remained in the country illegally, to receive a renewable two-year period of deferred action from deportation and to be eligible for work permits (Glum, 2017).

It is very important to note that DACA came into effect after the failed passing of the Dreamers Act in 2007 and in 2011, respectively. The so-called Dreamers Act would have provided a way for immigrants, brought into the United States after meeting certain qualifications, to be considered to become permanent residents of the United States of America. Nonetheless, after the passing of DACA policy in 2012, the immigrants had to satisfy certain qualifications before becoming accepted. Those qualifications were as follows: he/she had to be younger than 31 years old, must have entered the United States of America before turning 16 years, and lived in the United States before June 15, 2007.

Interestingly, in 2014, President Obama indicated his intentions on expanding the DACA immigration policy. As a result, in the year of 2016, the Migration Institute stated that about 1.9 million people were eligible for DACA status. However, while reviewing DACA records, many U.S. States disagreed with the expansion and, as a result, sued to prevent it. On September 5, 2017, under the presidency of Mr. Donald Trump and his administration, the DACA policy was rescinded, but it was delayed for six months to give Congress time to understand the policy fully and decide on how to deal with the issue. Indeed, the Trump administration wants tougher immigration and border security measures as well as crackdowns on sanctuary cities, green card restrictions and money for the President's border wall between the U.S. and Mexico.

**Figure 2.1 Demographic Classifications of DACA Recipients**

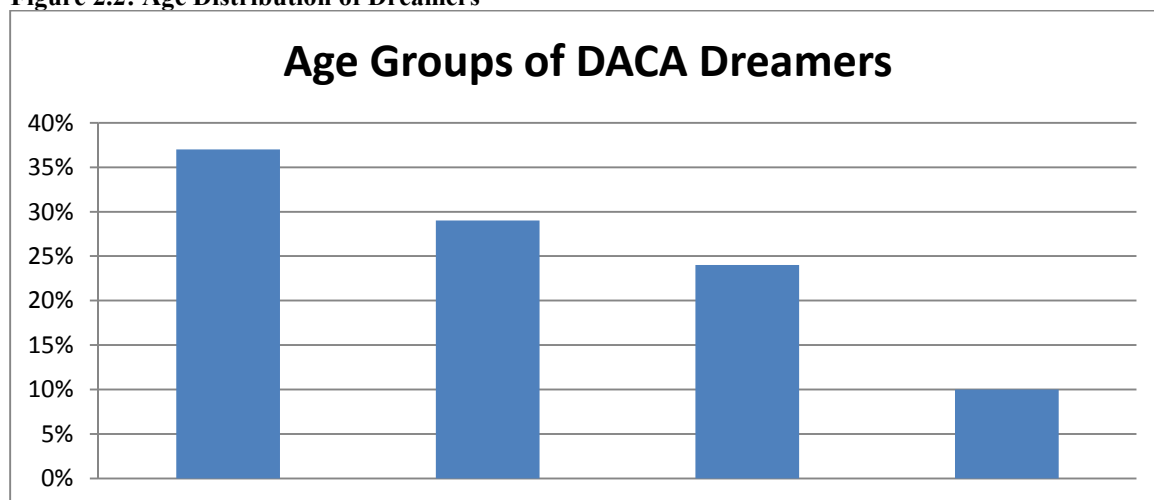
**Gender Distribution**



**Source of Data:** (Brannon, 2017 and CATO Institute, 2017)

It is reported that 53% of immigrants that use DACA are women while 47% are men. In addition, 83% are either single or divorced.

**Figure 2.2: Age Distribution of Dreamers**



**Source of Data:** (Lopez &Krogstad, 2017)

Also the Pew Research Center has stated that the average age of Dreamers enrolled in DACA is 24 years.

Also, twenty-five year-olds of the dreamers make up 29%, while 37% are of ages 21 through 25; 24% are ages 26 through 30, and 10% are of ages 31 through 36 (Lopez & Krogstad, 2017). Although it is a fact that DACA has a large number of immigrants as its recipients, many choose not to reapply or are no longer enrolled.

**The Economic Implications of DACA on Labor- force and Productivity (Gross Domestic Product-GDP)**

According to Gillett (2017), repealing DACA could cost about 700,000 DACA recipients or workers to lose to their jobs, and employers \$6.3 billion in employee turnover costs. Additionally, Gillett (2017) has explicitly stated on September 5, 2017 that the loss of labor of DACA recipients will cost the country \$460.3 billion in economic output over the next decade. Similarly, Center for American Progress (2017) has argued that if DACA recipients were deported and forced to leave the United States, the United States would stand to lose about \$460 billion in the Gross Domestic Product (GDP) over the next ten years.

In 2017, the Center for American Progress (CAP) Survey indicated that, of the roughly 3,000 DACA recipients, nine-tenths of the respondents stated that they had jobs. The survey further specified that DACA recipients have been working in the United States since they were children, with most of them holding jobs in important sectors of the US economy. However, the recent study of CAP (2017) reported that ending DACA would place severe economic strain on businesses around the country, putting them into the impossible and extremely costly position of having to fire productive employees for no other reason than arbitrary change in federal policy, potentially resulting in backlash from other employees or their broader community (Gillett, 2017).

**3.0 Methodology**

The study utilizes secondary and extant sources of immigration data on DACA immigrants between 2012 and 2015, coupled with labor-force data from 1995 to 2015. The extant data was obtained from the following agencies: United States of America’s Citizenship and Immigration Services, and U.S. Bureau of Labor-Statistics. Additionally, the study utilizes the Survivor function framework and a Cox Proportional Hazard (Cox PH) model to the sampled data. The study further adopted the Pearson’s chi-square test statistic to evaluate the null hypothesis. The data was analyzed using SPSS 16.0.

**3.1 A Survival Analysis of DACA Immigrants and the United States Labor-Force/Market**

**3.1.1 Review of Pearson Statistic**

The study of the annul DACA status in the United States of America labour-market was treated as an observational study. The Pearson chi-square test statistic for testing self-determination under the null-hypothesis (H0) is given as:

$$X^2 = \sum_i^2 \sum_j^2 \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \sim \chi^2 \dots\dots\dots \text{Equation 1}$$

Where  $O_{ij}$ ’s are the observed cell counts, and  $E_{ij}$ ’s the expected cell counts under the null hypothesis.

**Study Hypothesis**

The study theorized that the survivorship function of the United States of America labor–force depends on the type of DACA recipients' status in the labor market.

**H<sub>0</sub>**: The survivorship function of the United States of America labor–force do not depend on the type of DACA recipients' status in the labor market.

**H<sub>1</sub>**: The survivorship function of the United States of America labor–force depends on the type of DACA recipients' status in the labor market.

**3.1.2 Review of Survival Analysis Applications**

Survival analysis is a collection of statistical procedures for data analysis for which the outcome variable of interest is time-bound until an event occurs. The time may be in years, months, weeks, days, hours, minutes, and seconds. The event could be a crime, death of policy, disease progression, the death of living things, policy piloting experimental effects, treatment of diseases and so on. In this current study, the event of interest is on DACA policy effects on US labor-force.

**Survival function:** let T denote a continuous failure time random variable with probability distribution function of  $F_T(t) = \Pr(T \leq t)$  for a DACA recipients not being part of the labor force. The survival function proposed by Cox (1972) is given as  $S(t) = \Pr(T \geq t)$ . This means that probability of a DACA recipient being part of US labor-force at time t or probability that there was no negative DACA policy effect on the United States labor-market after time t.

**Hazard function:** According to Cox (1972), the hazard function is also described as the instantaneous failure rate,  $\lambda(t)$ . The  $\lambda(t)$  is the conditional probability that the time to labor-market/force defect will occur in the interval (t, t+dt) given that the labor-market/force defect has not occurred after time t. In other words, the rate of occurrence of the event at duration t equals the density of events at t, divided by the probability of surviving after t. It is algebraically, denoted as:  $\lambda(t) = f(t)/S(t)$ ..... Equation 2

**The Survivor Function Estimator**

Following the Kaplan-Meier (KM) estimator termed as the product limit estimator, was used to estimate the

survivorship function of United States of America labor–force based on the type of DACA recipients status in the labor-market. The KM estimator is given as:

$$\tilde{S}(t) = \pi_{j, l_j < t} \left( 1 - \frac{d_j}{r_j} \right) \dots \dots \dots \text{Equation 3}$$

Where, the  $l_1, l_2, \dots, l_k$  is the set of k distinct DACA recipients part of the US labor-force time observations in the sample,  $d_j$  is the number of DACA recipients part of the US labor-force at  $l_j$ , and  $r_j$  is the number of the individuals-DACA recipients’ “at risk” right before the  $j^{th}$  departing time (i.e. DACA recipients are being sacked at or after that time period). Note that, this particular model is a nonparametric method where no parametric distribution assumption was made about the population. However, the study used a log-rank test in the comparison of the survivorship of the US labor-force for the type of DACA recipients’ status in the labor market. Also by following **Cochrane-Mantel-Haenszel** test statistics, the study developed a log-rank test using a two-by-two (2X2) table. The log-rank test is obtained by constructing a two-by-two (2X2) table at each distinct DACA recipients part of the US labor-force time observations in years, and comparing the employed DACA recipients and non-unemployed but eligible (skilled) DACA recipients to supply labor to the labor market (DACA recipients fresh graduates), conditional on the number at risk in the groups. Recall that  $l_1, l_2, \dots, l_k$  is the set of k ordered distinct DACA recipients part of the US labor-force times. At the  $j^{th}$  departing time (i.e. DACA recipients are being sacked at or after that time period), we expect to have the following table:

LABOR FORCE	DACA RECIPIENTS STATUS IN THE LABOR MARKET		TOTAL
	YES	NO	
0 = Part of Labor Market	$d_{0j}$	$r_{0j} - d_{0j}$	$r_{0j}$
1= Eligible (DACA Graduates)	$d_{1j}$	$r_{1j} - d_{1j}$	$r_{1j}$
TOTAL	$d_j$	$r_j - d_j$	$r_j$

**Source:** Revised of Cochrane-Mantel-Haenszel test statistics 2X2 table

Where  $d_{0j}$  and  $d_{1j}$  are the number of eligible labor supply in group 0 (DACA recipients’ part of the labor market), and group 1 (DACA recipients graduates or school going age eligible to supply labor) respectively at the  $j^{th}$  departing times, and  $r_{0j}$  and  $r_{1j}$  are the number of DACA recipients at risk at that time, in group 0 and 1 respectively.

Therefore, the log-rank test statistics is given as below:

$$X^2_{\log rank} = \frac{[\sum_{j=1}^k (d_{0j} - r_{0j} * d_j / r_j)]^2}{\sum_{j=1}^k \frac{r_{1j} r_{0j} d_j (r_j - d_j)}{[r_j^2 (r_j - 1)]}} \dots \dots \dots \text{Equation 4}$$

**The Cox Proportional Hazard (PH) Model**

By following Cox (1972), the Cox Proportional Hazard (PH) Model was adopted to establish the relationship between the US labor market/force and some selected independence variables. The Cox PH model was used in modeling the survival and analyzing the effect of risk factors on survival time. Additionally, the Cox PH model is a semi-parametric model since there is no assumption concerning the nature or shape of the underlying survival distribution. By assumption, given the hazard rate at the time as:  $h(t/X)$ , then the baseline hazard function would be set at  $h_0(t)$  depending on the time. The X’s are the explanatory variables or independent variables, and the Beta’s ( $\beta$ ’s) are the parameters in the linear predictor model, as shown below:

$$h(t/X) = h_0(t) \exp (X_1 \beta_1 + \dots + X_k \beta_k) \dots \dots \dots \text{Equation 5}$$

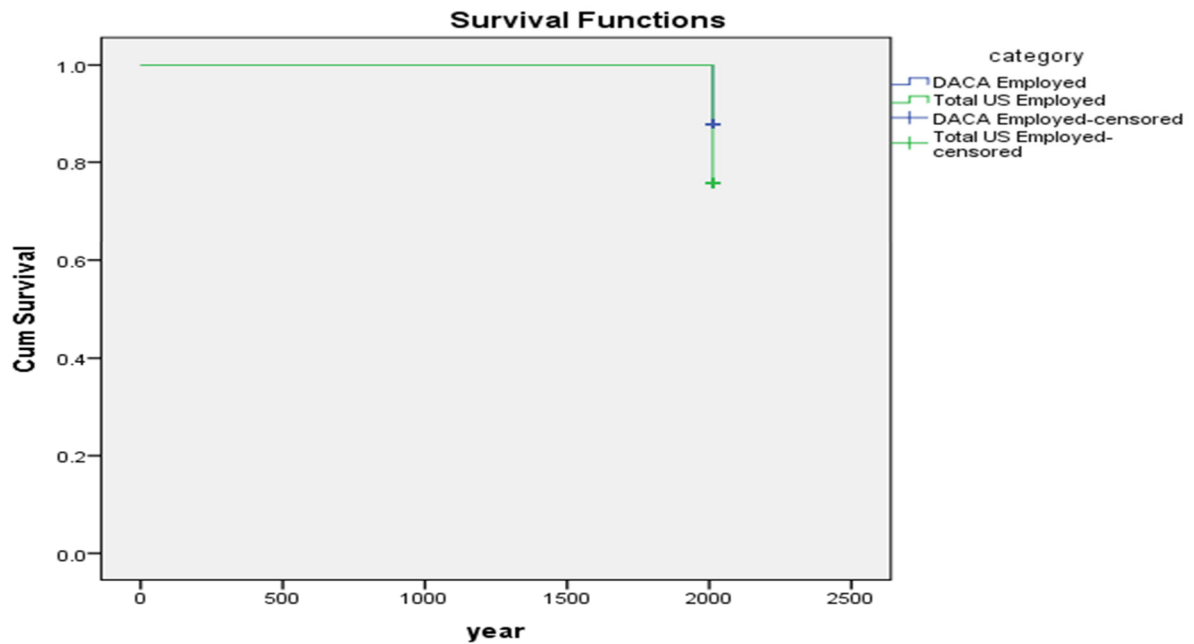
The hazard rate is the probability of the DACA recipients leaving the US labor market/force in time interval given that the DACA dreamers would have survived deportation per a given period of time. Another important assumption of Cox PH model is that hazard ratio is constant over time meaning that the survival curves of groups do not cross each other. Again, the baseline hazard function need not be estimated in order to estimate the parameters. Lastly, the inferences can be made about the effect of parameters without the knowledge of the baseline hazard function. For the purpose of this study a modified Cox PH model was followed as given below:

$$h(t/X) = h_0(t) \exp (\beta_1 X_1 * t + \beta_2 X_2 * t) \dots \dots \dots \text{Equation 6}$$

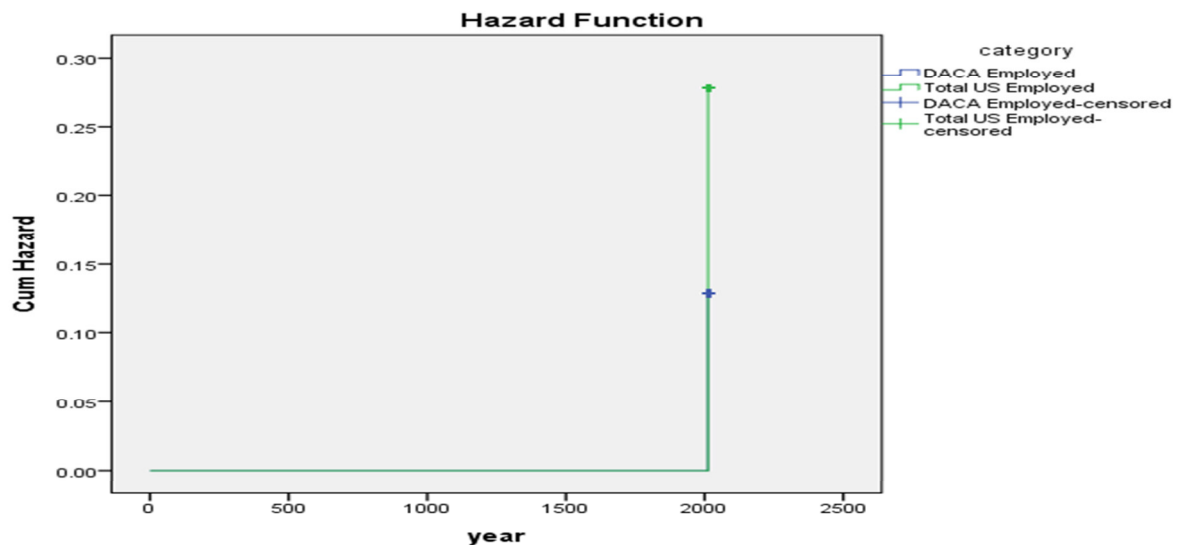
The partial likelihood method was used to estimate the parameters in equation six (6). Very importantly, the Cox PH model has the flexibility to introduce time-dependent explanatory variables and handle censoring of survival times due to its use of the partial likelihood function. Finally, the parameter estimates in the Cox PH model are obtained by maximizing the partial likelihood as opposed to the likelihood of occurrences and not occurring.

#### 4.0 Data Presentation

**Figure 4.1:** Survival Function for US Labor Force/Market and Employed DACA Recipients



**Figure 4.2:** The hazard Function for US Labor Force/Market and Employed DACA Recipients



**Table 4.1:** Means and Medians for Survival Time

Category	Mean <sup>a</sup>			
	Estimate	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
DACA Employed	2014.637	.031	2014.576	2014.699
Total US Employed	2014.272	.026	2014.220	2014.324
Overall	2014.378	.021	2014.337	2014.420

**Note:** Estimation is limited to the largest survival time if it is censored.

**Table 4.2:** Overall Comparisons Test For the Null Hypothesis

	Chi-Square	Df	Sig. (P-values)
Log Rank (Mantel-Cox regression)	61.994	4	.000
Breslow (Generalized Wilcoxon)	61.994	4	.000
Tarone-Ware	61.994	4	.000

#### 4.1 Discussion

Figure 4.1 shows the survival function/graph for U.S. labor force and employed DACA recipients as well as eligible DACA graduates. From the survival graph in figure 4.1, given the assumption of the same time limit, U.S. labor force has about 78% survival within the United States economy, with the absence of the labor force from DACA recipients. However, when the DACA employees are added, under the same conditions, the survival of the labor force now goes to 90%, with a growth factor of 12%. This implies that the stability, survival, and growth of the United States labor market/force do not rely on only the natives or the citizens of United States. Additionally, the data and the survival analysis further reveal that the United States of America businesses, companies, entrepreneurs, and other money-generating ventures also depends on DACA employees for their profit making.

Figure 4.2 demonstrates the hazard function/graph for U.S. labor force and employed DACA recipients. From the hazard function in figure 4.1, given the assumption of the same time limit, the total U.S. labor force will experience the total risk (or cumulative hazard) rate of about 30% within the United States economy. The experience of the hazard rate or risk in the long-run will affect the totality of the United States businesses, companies, entrepreneurs, and other money-generating ventures in the economy. However, out of the 30% cumulative hazard rate experienced by the entire economy, about 12% will be borne by the fewer DACA employees who will be suffered from deportation. This implies that the stability, survival, and growth of the United States labor market/force will be impeded by 18% risk or hazard rate from the labor loss. Towards this end, United States labor force, market, businesses, and firms' e.t.c will suffer greatly from the 18% risk of labor loss from the economy.

Table 4.1 is a descriptive survival table that details the time until the deportation takes effect (or the DACA policy wind-down). It is analyzed by using the mean time factor. The table is sectioned by each level of U.S. labor market sections, and each observation occupies its own row in the table. It is very important to note that the multiple cases of each level of U.S. labor market sections/forces experience the terminal event at the same time; these estimates are printed once for that time period and apply to all the cases whose effect took place at that time.

Table 4.2 demonstrates the test of equality of survival distributions for the different levels of categories. The equality of the survival distribution asserted that the survival of U.S. labor force depends on both employed citizens/natives and employed DACA recipients (DACA existing labor force) as well as eligible DACA graduates willing to supply labor. The estimation table provides overall tests of the equality of effect across groups (Employed natives and Employed DACA recipients). The null hypothesis of the survival distribution stated that there is no significant difference between total U.S. labor force and DACA recipient labor force. This implies that survival of total U.S. labor force does not depend on DACA recipients' labor force against the alternative hypothesis that there exists a significant difference between total U.S. labor force and DACA recipient labor force. That is, the survival of total US labor does depend on DACA recipients' labor force. This is because the significance p-values of the tests (log-rank (Mantel-Cox regression), Breslow (Generalised Wilcoxon), and Tarone-Ware) are all less than 0.05. This implies that there exists a statistical difference between the two employable groups at 1%, 5% and 10% significance level. In conclusion, the survival of the total U.S. labor force as well as the market depends greatly on the DACA recipients (both employed and eligible employable graduates).

#### 5.0 Conclusion and Policy Recommendation

For the continuous growth and survival of the labor force of the United States of America, there is the need for continuous existence and expansion of the DACA policy. It is not, therefore, surprising that President Obama decided to expand the DACA policy in 2014. However, the deportation of DACA recipients by the Trump administration is likely to inflict a devastating consequence (i.e. based on the cumulative hazard rate of 30%) on U.S. labor force, as well as the dire, far-reaching consequences to the DACA employees, the employers, and to the American economy across all regions and sectors, if the policy is not properly reviewed.

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